

Red Planet Recycle Supervisor Meeting

Tuesday 29 November 2011 at 2.00pm

Alrick Building Classroom 10

Minutes

Group Members Attending

Yassen Abbas (Y.A)

Jamie Cassels (J.C)

Malcolm Chambers (M.C)

Scott Clark (S.C)

Gareth Herron (G.H)

Sam Jones (S.J)

Dylan Martin (D.M)

Bo Peng (B.P)

Charlotte Raymond (C.R)

Samuel Walpole (S.W)

James Young (J.Y)

Apologies for Absence

None

Meeting Agenda

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1. Discussion of Recycling Processes Identified

- i. Water Recycling Processes – Walpole.S + Herron.G
- ii. Biomass Recycling Processes – Abbas.Y + Chambers.M
- iii. Waste Recycling Processes – Peng.B + Martin.D
- iv. Thermal Recycling Processes – Doig.L + Young.J
- v. Air Recycling Processes – Cassels.J + Raymond.C
- vi. Food Recycling Processes – Clark.S + Jones.S

2. General Design Questions for Supervisors

3. Allocation of Tasks for the Festive Period

4. Election of Chairman and Secretary for the next meeting

Minutes

1 – Presentation of findings

The results of the allocated tasks were presented;

General discussion from Dr Sarkisov and Dr Valluri instructing us to not discount any methods without doing a SWOT analysis.

2 – Questions Raised

In response to questions raised Dr Sarkisov and Dr Valluri suggested several key guidelines;

General Comments about design considerations.

- Put all processes on a spreadsheet to allow for direct comparison.
- Justify all design choices (use quantitative methods to show why you will not be using a certain process).

- Air, water and thermal recycling are essential (don't concentrate on the failure of components if it doesn't affect the sustainability of the habitat).
- Must specify a design basis and flowrate to work from.

Specific feedback

i. Water Recycling Processes – Walpole.S + Herron.G

- Technology must be prioritised for use on Mars
- Usage of bioremediation would be possible on separated streams of waste water (laundry, solid waste, liquid waste etc).
- Electro-coagulation not viable for dissolved chemicals.
- Look at specific membrane processes for our waste water streams.
- With non-regenerative processes – must replace the units (413 kg/year), how much water is treated and is this cost less than that of importing water?
- Lyophilizer cannot be 100% efficient, must be more realistic value (>99%).

Specific questions for SW and GH.

- Can certain technologies be used together, if so are there advantages?
- What is the unit size for 5year replenishment (membrane separations)?

ii. Biomass Recycling Processes – Abbas.Y + Chambers.M

Biomass recycling isn't required early on, think about this later on (after stage 3?)

iii. Waste Recycling Processes – Peng.B + Martin.D

- Can assume that all food is eaten
- Never mix 2 dirty streams to produce a clean stream
- Solid waste should be fine for JAXA process (handles organic waste)
- Some concerns were raised regarding JAXA process as Dr Sarkisov and Dr Valluri did not think the concept was viable.

Specific questions for BP and DM

- How does low gravity affect condenser operation, (surface tension becomes dominating factor meaning separation won't occur i.e. liquid phase will not fall).
- This should be okay on Mars as gravity is not low enough to prevent condenser operation .

- iv. Thermal Recycling Processes – Doig.L + Young.J
 - Assume perfect insulation and no radiation will enter the station.
 - Uneven temperature Temp distribution causes discomfort.
 - Must have a PFD in place before HI can really take place.
- v. Air Recycling Processes – Cassels.J + Raymond.C
 - Will the oxygen resupply be running at steady state or a cyclic process?
- vi. Food Recycling Processes – Clark.S + Jones.S
 - For now assume that food will always be supplied.
Later (once the rest of the design is complete) this can be looked into.

3 – Discussion and Conclusion

The recycling methods were discussed and it was decided that another meeting would be held on Friday (without Dr Sarkisov and Dr Valluri) to allow us to sort out work assignments over the festive period.

This was due to Dr Sarkisov requesting that the group attend a lecture at 4pm and therefore the meeting would be concluded on Friday.

4/5 – Next Steps and Sub-Groups

The next step is doing a micro-feasibility study for each of the recycling methods in Air and water. A design basis was created at the meeting and each study will be compared with the design basis and the other recycling methods to allow us to quantitatively discount some methods from the final design.

The allocation of work is given below (or as Christmas Tasks.docx on the redplanet recycle wiki page)

For each process, provide a mini feasibility study. Quantitative results for comparison if possible & flow sheet for that process.

Air:

- Sabatier Reaction (JC)
- Reverse Water Gas Shift Reaction (CR)
- Bosch Reaction (JY)

Water:

Biological Tech

- Digestion (DM)
- Bio-Reactor Systems (YA)
- Fermentation (DM)
- Bioremediation (BP)
- Membrane Separations (LD)

Chemical Tech

- Advanced Oxidation Processes (BP)
- Electrocoagulations (MC)
- Membrane Separations (LD)
- Ultraviolet Sterilisation (SC)
- Supercritical CO₂ (SJ)

4 mains types of water purification in space are

- ISS Baseline Technology (SJ)
- Vapour Phase Catalytic Ammonia Reactor (VPCAR) (GH)
- Direct Osmotic Concentration (DOC) (GH)
- Immobilised-cell Bioreactor (ICB) (SW)

Interim Report (to be compiled by MC, SC and YA):

- 5 pages, or as concise as possible
- Contains all recycling process we are looking at
- Contains design basis
 - List of assumptions
 - Initial requirement

6 – New Position Holders

J.C was appointed as the chairman for the 17/01/2012 meeting.

Y.A was appointed as the secretary for the 17/01/2012 meeting.

7 – Questions about new tasks

No questions concerning the new tasks assigned were raised during the meeting.